THE CHURCH OF
JESUS CHRIST
OF LATTER-DAY SAINTS

March 4, 1999

REAL ESTATE DIVISION
Twelfth Floor East
50 East North Temple Street
Salt Lake City, Utah 84150-0012
Phone: 1-801-240-3840
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Reference reply to:

Mr. Christopher R. Hudon, Coordinator
Water Use Program
1594 West North Temple Street
Suite 220, Box 146300
Salt Lake City, Utah 84114-6300

Dear Mr. Hudon:

In response to your letters of January 6, 1999, enclosed are reports on the commercial and industrial use of water from our wells in the vicinity of Salt Lake City. These wells are described as follows:

Property Number	Property Description	WU Number	Use	Well Number	W.R. Number
506-6921	Church Office Building and Temple Square	2008	Heating and cooling of buildings	1 2 3 4 Drain to City Crk	57-2931 57-2931 57-2931 57-2931 57-2931
527-6454	Eagle Gate Tower office Building 70 E South Temple St	10830	Building	n/a	57-927
515-2380	Industrial Park at 3600 W 5700 S Salt Lake City (Westlakes 969)	2806	Watering a golf course and maintaining wetlands and ponds	1 2 3	59-5491 59-1662 59-4670 59-5500 59-5499 59-4465

In addition to the three wells indicated above on the Westlakes property, there are seven other small wells on the property which currently are not being pumped. The water rights for these wells have been commingled with those for wells 1, 2, and 3. Wells 1, 2, and 3 are at present being equipped with new pumps, and it is anticipated that they will be pumped beginning this coming summer. Water meters will be installed and an irrigation water sample will be taken each year.

If you have any questions or require additional data, please call.

Sincerely,

Grant S. Cooper
Engineer

cc: Mark Staples
Zions Securities

Utah State UNIVERSITY

USU ANALYTICAL LABORATORIES
Ag Science 166
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February 25, 1999

Paul Riley
244 E 970 N
Logan, UT 84321

57-2951
005589
entered

Water Sample Received 2/5/99

USU #	EC	Na	Ca+Mg	SO4	Cl	HCO3	ResCO3	B	SAR	Class	SARadj.
	umhos/cm	meq/L						---mg/L---			
1000	1300	3.36 77	10.20	3.51 168	4.18 148	6.07 370	0.00	0.14	1.49	C3-S1	3.83

Refer to Enclosed Water Quality Guide.
If you have any questions, please contact your County Agent, Dr. Rich Koenig (435-797-2278), or this lab.

WATER QUALITY ANALYSIS
(For Irrigation)

Total Salt (Salinity)

Plants remove much water from the soil but only a small amount of soluble salt. Evaporation also removes water, but no salt. Salts contained in irrigation water can therefore be removed effectively only by applying enough excess water to leach them downward, out of the root zone and into the underground drainage system. Indicated "leaching requirements" give the amount of water (%), in *excess* of crop requirements, which must be applied and drained down through the root zone in order to control salt accumulation. Crops vary widely in their salt tolerance, as indicated in the table on the reverse side of this sheet.

Sodium Hazard

Soils high in adsorbed sodium (sodic soils) are hard to wet when irrigated, tend to run together when wet, have low permeability and are difficult to drain. When dry, they form hard clods and large cracks. A good soil can be converted to a sodic soil by irrigation with water that is high in sodium relative to calcium and magnesium (a high sodium adsorption ratio or SAR). Also, bicarbonate in the water can convert the calcium and magnesium to insoluble forms in the soil and thus increase the sodium hazard. If the amount of bicarbonate is greater than the Ca + Mg, the difference is called "Residual Sodium Carbonate."

USDA Handbook 60 Evaluation

Electrical Conductivity (Salinity)

Class C1 (Conductivity 0-250). This LOW SALINITY water can be used to irrigate all crops on all soils with little likelihood that soil salinity will develop. Some leaching is required, but this usually occurs under normal irrigation practices. Application of this water to new land high in sodium salts may cause a sodic condition to develop.

Class C2 (Conductivity 250-750). This MEDIUM SALINITY water can be used on most soils. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control. Leaching requirement 5-15%.

Class C3 (Conductivity 750-2250). HIGH SALINITY water should not be used on soils with restricted drainage. It can be used with crops having medium to high salt tolerance on light soils having good drainage and with irrigation practices which provide appreciable leaching. Leaching requirement 15-25%.

Class C4 (Conductivity 2250-5000). VERY HIGH SALINITY water is not suitable for irrigation under ordinary conditions. It may be used successfully with crops of high salt tolerance, on light and well-drained soils, and with very carefully conducted soil and water management practices. Leaching requirement 25-65%. Winter or early spring leaching should be practiced on most soils to insure removal of salts remaining from the previous season.

Class C5 (Conductivity over 5000). This water is generally unsuitable except in an emergency to prevent loss of a crop on soils with good drainage. Any such use should be followed by leaching with better water.

Sodium (Alkalinity)

Class S1. LOW SODIUM water can be used on all soils with little sodium hazard.

Class S2 MEDIUM SODIUM water will present an appreciable sodium hazard in fine-textured soils, especially under low-leaching conditions, unless gypsum is present in the soil. This water may be used on coarse-textured or organic soils having good permeability.

Class S3. HIGH SODIUM water may produce harmful levels of sodium in most soils and will require special soil management–good drainage, high leaching, and addition of organic matter. Soils high in gypsum may not develop harmful effects from such water, and the effects may be less in soils high in lime. Chemical amendments may be of benefit if the water is not too high in salinity (C3 or better).

Class S4 VERY HIGH SODIUM water is generally unsatisfactory for irrigation purposes except at salinity levels C1 and perhaps C2, where addition of amendments or dissolving of calcium from the soil may reduce the proportion of sodium in the soil solution.

Residual Sodium Carbonate

0 to 1.25 meq/1: probably safe
1.25 to 2.5 meq/1: marginal
More than 2.5 meq/1: not suitable for irrigation

SUPPLEMENTAL EVALUATION

Sodium Hazard

The term "Adjusted Sodium Adsorption Ratio" (SAR_{adj}) is calculated to take into account the total salinity and the concentration of sodium relative to calcium + magnesium, and the bicarbonate.

Root absorption of sodium can also cause specific toxicity problems, primarily for trees, vines, and woody ornamentals. Annual crops are usually not affected by sodium except for its contribution to total salt content. Water with SAR_{adj} below 3: no problem; from 3 to 9: problems increase; above 9: problems are severe.

Leaf absorption of sodium (from sprinklers) can cause toxicity symptoms under some conditions if the sodium exceeds 3 meq/1.

Chloride Hazard

Chlorides are found in all natural waters, and normally cause no problems. In high concentrations, however, chlorides can inhibit plant growth and they are specifically toxic to some plants.

Chlorides (meq/1)	
0-2	Generally safe for all plants.
2-4	Sensitive plants may show slight to moderate injury.
4-10	Moderately tolerant plants usually show slight to substantial injury.
10+	Severe problems.

3 or more (sprinklers) may cause problems under adverse conditions.

Sprinkler Irrigation

When the rate of evaporation is high (low humidity, high temperature, high wind), leaf burn may occur at levels of salinity, sodium and chloride that would be safe under less severe conditions. Usually there is no problem if salinity is less than 1200 µmhos/cm and sodium and chloride are less than 3 meq/1. At higher levels, it may be advisable to increase rate of rotation or to sprinkle only at night during periods of hot, dry weather.

SOIL PROBLEM	DEGREE OF PROBLEM		
	None	Increasing	Severe
Salinity (µmhos/cm)	0-750	750-3000	3000+
Sodium (SAR_{adj})	0-6	6-9	9+
Residual carbonate (meq/1)	0-1.2	1.2-2.5	2.5+

TOXICITY TO CROPS	DEGREE OF PROBLEM		
	None	Increasing	Severe
Furrow or flood:			
Sodium (SAR_{adj})	0-3	3-9	9+
Chloride (meq/1)	0-4	4-10	10+
Boron (ppm)	0-.5	.5-2	2+
Sprinklers:			
Sodium (meq/1)	0-3	3+	—
Chloride (meq/1)	0-3	3+	—

CROP TOLERANCE TO SALINITY* and LEACHING REQUIREMENT

Crop	EC water µmhos/cm	ECe Soil mmho/cm	Leach. Req. %	Crop	EC water µmhos/cm	ECe Soil mmho/cm	Leach. Req. %
FIELD CROPS							
Barley	5300	8.0	12	Soybean	2500	3.7	10
Sugar beet	4500	6.7	11	Corn	2200	3.3	12
Wheat	3100	4.7	8	Beans	700	1.0	6
VEGETABLE CROPS							
Beets	3500	5.3	11	Onion	900	1.3	8
Tomato	1800	2.7	8	Carrot	700	1.0	6
Potato	1100	1.7	6	Beans	700	1.0	7
Sweet Corn	1100	1.7	6				
FRUIT CROPS							
Apple/pear	1100	1.7	7	Raspberry	800	1.8	8
Apricot/peach	1100	1.7	7	Strawberry	700	1.0	7
FORAGE CROPS							
Tall wheatgrass	4900	7.3	11	Alfalfa	1300	2.0	5
Barley (hay)	3500	5.3	10	Orchard grass	1300	1.7	4
Tall fescue	—	3.9	—	Alsike, Ladino, Red, Strawberry	900	1.5	4-6
Reed canary grass	—	—	—				
Brome grass	—	—	—	Sweet clover	—	—	—

*Values shown are maximum for no appreciable loss in yield. For approximately 10% yield reduction, multiply each value by 1.5.

BORON HAZARD

A small amount of boron is necessary for plant growth. Most Utah soils have adequate boron for crops, and most surface waters carry it. Some wells and saline waters contain toxic levels, and should be avoided.

Boron (ppm)	Toxicity
0.0-0.5	Safe for all crops
0.5-1.0	Sensitive crops show slight to moderate injury
1.0-2.0	Semitolerant crops show slight to moderate injury
2.0-4.0	Tolerant crops show slight to moderate injury
4.0+	Unsatisfactory for all crops

Relative Tolerance of Plants to Boron

(In each group the plants first named are considered as being more sensitive and the last named more tolerant)

Sensitive 0.5 ppm	Semi-Tolerant 1 ppm	Tolerant 2 ppm
Apricot	Tomato	Carrot
Peach	Oat	Lettuce
Cherry	Corn	Cabbage
Grape	Wheat	Onion
Apple	Barley	Alfalfa
Pear	Field Pea	Sugar Beet
Plum	Potato	
1 ppm	2 ppm	10 ppm

Adapted from USDA Tech. Bul. No. 448.